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FACTORS AFFECTING PUBLIC SCHOOL EXPENDITURES

by

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Factors Affecting Public School Expenditures

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The objective of this study is to estimate the impact of various factors which affect public school expenditures. Total expenditures have risen rapidly from increases in enrollment and increases in expenditures per student. While school support from state and federal sources has increased, the major source of school resources is still the local property tax. Residents of local communities are becoming more reluctant to increase property taxes. A search for new alternatives in financing public schools has resulted. Another incentive for this search has come from recent court decisions regarding equality among school districts, for example, the Serrano vs. Priest case in California. These decisions raise major questions with respect to what is to be equalized and how it is to be done; but more importantly, they are likely the result in further increases in expenditures.

With future increases in school expenditures likely, it is important to study the efficiency of school systems. Are there economies from increasing the size of schools or school districts? What are the factors which have major impacts on cost? Of these factors, which are subject to control by school boards? What influences the level of expenditures provided to schools by the residents of a school district? Results for three functional relationships are presented: 1) a reduced form relationship which includes factors from both the cost of providing schooling and the

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public demand for schooling, 2) a public demand for schooling relationship, and 3) a cost relationship. The sample consists of 638 school districts of the Ohio Public School System for the 1968-69 school year. The impacts of economies of scale and factor input, district, and student body characteristics on school expenditures per student are tested and compared to the results of previous research.

The Ohio Public School System

Expenditure and enrollment trends in the Ohio Public School System, presented in Tables 1 and 2, show rapid increases since 1949-50, with some leveling of enrollment in recent years. The three types of districts are similar in tax structure, state and federal aid, and in structure. All types are dominated by multiplant districts as opposed to single plant districts. Even the local districts currently have a mean average daily membership in excess of 2,000 students. Some local districts include an entire county.

One difference is that city districts have greater enrollment and expenditures than the other two classes. A second difference is that city and exempted village districts operate independently of County Boards of Education and provide all school services. Local districts are subject to and receive some services from their respective County Boards. In the expenditure data, however, the costs of services provided by County Boards of Education are allocated to the local districts to make expenditures comparable to those in city and exempted village districts.

From a base of 646 districts at the end of the 1968-69 school year, 5 were deleted because of incomplete data and 3 were deleted because they represented special situations. The data are drawn from four annual

Table 1

Operating Expenditures per Pupil, by Type of District, Ohio*

Year	City	Exempted Village	Local	State
1949-50	$207.35	$169.04	$169.53	$190.02
1954-55	266.56	226.72	220.61	247.43
1959-60	351.46	311.72	312.92	330.67
1964-65	422.44	389.11	381.73	406.58
1967-68	596.27	514.73	522.14	565.99
1968-69	644.22	562.93	552.30	608.25
1969-70	718.99	588.80	594.41	677.87
1970-71	781.46	646.88	647.69	739.56

Source: Costs per Pupil, 1970-71, Division of Computer Services and Statistical Reports, State of Ohio, Department of Education, 1971, p. vii.

* Excludes expenditures for capital outlay, debt retirement, and interest. There are, in addition, variations in the definition of operating expenditures from year to year as to which federal and state programs are included. In more recent years, the definition has been made more consistent with national accounting definitions.

Table 2

Student Enrollment Trends, by Type of District, Ohio*

	City			Exempted Village		
Year	ADM ('000)	# of Districts	ADM District	ADM ('000)	# of Districts	ADM District
1949-50	646.5	113	5,721	90.2	89	1,014
1954-55	856.7	135	6,346	99.6	81	1,230
1959-60	1,067.2	141	7,568	119.7	77	1,555
1964-65	1,330.5	159	8,368	114.9	62	1,853
1967-68	1,339.7	163	8,219	109.2	54	2,023
1968-69	1,380.7	168	8,218	100.1	50	2,003
1969-70	1,451.2	171	8,487	107.4	50	2,148
1970-71	1,447.6	173	8,368	107.8	50	2,156

Sources: Costs per Pupil, Division of Computer Services and Statistical Reports, State of Ohio, Department of Education, various years.

State Board of Education, Annual Report, various years.

* ADM = average daily membership.
NA = not available; # of local districts is not available for 1949-50 and 1954-55, which precludes computation of ADM/District for Local and State in these years.
Kindergarten ADM is not included for some years, is fully included for others, and is included at 0.5 for the remainder.

** As the per cent of that class enrolling in first grade.

Table 2 (Continued)

	Local			State				
Year	ADM ('000)	# of Districts	ADM / District	ADM ('000)	# of Districts	ADM / District	High School Graduates (%) **	Plan to Attend College (%)
1949-50	445.5	NA	NA	1,182.2	NA	NA	52.8	NA
1954-55	544.4	NA	NA	1,500.7	NA	NA	55.3	NA
1959-60	653.7	710	921	1,840.6	928	1,983	67.7	NA
1964-65	769.5	533	1,444	2,214.9	754	2,938	75.5	40.4
1967-68	802.1	463	1,732	2,251.0	680	3,310	76.2	41.4
1968-69	807.8	428	1,887	2,288.6	646	3,543	76.2	41.9
1969-70	839.9	417	2,014	2,398.5	638	3,759	80.6	42.0
1970-71	884.9	407	2,174	2,400.2	630	3,810	NA	NA

reports which each school district completes for the State Department of Education plus a special survey on racial composition of school districts completed during 1968-69. Characteristics of the Ohio school system for the 1968-69 school year are presented in Table 3. Enrollment in Spring, 1969, ranged from 86 to 144,975 students. Operating expenses ranged from $395 to $1,380 per student. The operating portion of transportation costs, included in operating expenses, average $13, $20, and $31, respectively, in city, exempted village, and local districts.

A shortcoming of this study is the inability to control for the extent of vocational education among school districts. Vocational education is a significant part of the programs of many districts in Ohio. Although the impact of vocational programs on district costs cannot be determined from the current sample, information from the recently established joint vocational school districts in Ohio indicates that vocational education is expensive. In 1970-71 operating expenses averaged $1,223 per student for 15 vocational districts, with a range of $922 to $1,453. These districts had an average of 704 students per district.

An Expenditure Model

In this study the public school district is treated as a firm. Its behavior is described by a simultaneous equations system composed of the following three equations:

(1) $S = S_o$ Private Demand

(2) $E = f(W, I, K)$ Social Demand,

(3) $Y = g(E, S, P, Z)$ Cost,

where S is the number of public school students per district, E is education per student (median achievement, dropout rate), W is taxable

Table 3

Characteristics of the Ohio Public School Districts, 1968-69

(Mean with Standard Deviation in Parentheses)

	State	City	Exempted Village	Local
Enrollment, Spring (Students)	3,693 (9,021)	8,478 (16,513)	2,087 (1,557)	1,971 (1,511)
Operating Expenses ($/Student)	569 (107)	616 (123)	546 (99)	553 (95)
Tax Value/Student ($/Student)	14,178 (9,893)	16,979 (9,550)	13,449 (7,066)	13,144 (10,116)
White/Total	.965 (.082)	.932 (.108)	.972 (.052)	.977 (.068)
ADA/ADM	.945 (.012)	.943 (.010)	.948 (.008)	.946 (.013)
Enrollment, Spring, 1969 / Enrollment, Autumn, 1968	.990 (.046)	.989 (.013)	.990 (.019)	.990 (.055)
Enrollment, Spring, 1969 / Enrollment, Spring, 1967	1.043 (.061)	1.036 (.056)	1.039 (.060)	1.046 (.063)
Teacher/Pupil	.047 (.009)	.047 (.005)	.046 (.005)	.047 (.011)
Masters Degree / Total Teachers	.186 (.083)	.246 (.083)	.199 (.094)	.161 (.068)
Over 10 Years Experience / Total Teachers	.398 (.099)	.431 (.103)	.415 (.085)	.383 (.096)

real property value of district per student, I is per capita income of the district, K is per capita stock of knowledge of the district (median years of schooling), Y is school operating expenses per student, P is a vector of prices of factors of production, and Z is a vector of characteristics of the student body (racial and age composition).

Equations (2) and (3) are per student per year of schooling. Equation (1) states that the student body of each public school district is predetermined. This assumption is partially justified by mandatory attendance laws. Since school resources come almost entirely from public sources, equations (2) and (3) play a more direct role in expenditure determination. 1/

In equation (2), the social demand for education per student is determined by taxable real property value per student (the ability to finance education) and the per capita income and knowledge of residents of the district (the social income effect), The equation is specific to present methods of financing education. A wealth measure is used as a proxy for the marginal social cost of financing education instead of a marginal tax rate because it is wealth which determines the increase in tax rate necessary to achieve a unit increase in education per student. Further, equation (2) is a district social demand function. Within the state all districts face the same set of state and federal aid programs. However, state and federal aid will affect districts differently to the

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1/ The major reason for this assumption is lack of sufficient data to handle such a relationship. The private demand for education at the district level could be specified as:

(1') $S = s(E, I, K, N, R, W)$,

where N is the student age population of the district, R is alternative sources of education (parochial schools) and W is market wage rates (employment opportunities).

extent that access to funds from state and federal programs is related to district characteristics.

The cost of education per student, equation (3), is determined by the quantity of education per student, the size of the district, factor prices, and student input represented by characteristics of the student body. Substituting equation (2) into (3), the reduced form equation for school expenditure determination is obtained:

(4) $Y = h(W, I, K, S, P, Z)$.

This and equation (3) are the basic relationships estimated in previous research on public school expenditures. Empirically, the major difference between these equations is whether or not a measure of district wealth per student (assessed real property value for example) is used. Empirical measures of E such as achievement test scores, dropout rates, or attendance rates are in part also measures of student characteristics (Z). Factor prices (P) are usually available for only part of the school inputs, so observations on factor characteristics such as teacher characteristics, class loads, and physical facilities are used. These are also partial measures of E. The vector Z often includes some form of I and K.

The equations used by Cohn [1], Katzman [4], and Riew [5] are considered cost functions; those used by Hanson [2], Hirsch [3], and Shapiro [6] reduced form expenditure functions. These studies also differ in whether the school or the school district is the unit of observation.

With the exception of Hirsch [3], all of these studies found significant economies of scale in school cost or expenditure functions. Several studies also found diseconomies of scale beyond an optimum sized unit. Cohn [1], in his study of Iowa high school districts, found minimum cost

operation at 1,500 - 2,200 students. His sample, although at the district level, is dominated by single school districts. Riew [5], in his study of single school high school districts in Wisconsin, found minimum cost operation at 1,675 students. Katzman [4, pp. 85-90] found minimum cost enrollment levels of 1,400 to 1,800 students for multiplant elementary districts in Boston. Hanson [2], for school districts in several states, found optimum school district size had a median of about 50,000 students, with a range from 20,000 in Nebraska to 160,000 in New York. Hanson differs from the other studies because it is a study of district operations and includes large city school systems. Shapiro [6], finds some evidence of diseconomies in large school districts in Alberta, Canada.

The quality of the teaching staff shows a significant positive impact on school expenditures in Cohn [1], Katzman [4], and Riew [5]. Variables representing teaching load, e.g., the pupil-teacher ratio and courses taught per teacher, show a negative effect in Katzman [4] and Riew [5].

The assessed value of real property per student shows a strong positive impact on school expenditures in Hirsch [3] and Shapiro [6]. Hirsch also finds a positive relationship between school expenditures and per capita income in St. Louis County. Katzman [4, pp. 121-122] reviews several studies which examine the relationship between school expenditures and district characteristics.

Other factors also affect school expenditures in varying degrees. Some of these are physical facilities, population density of the district, various student characteristics, and changes over time in public school enrollment.

Statistical Analysis

Estimates of equations (2), (3) and (4) are presented in Tables 4, 5, and 6, respectively. All equations are quadratic in enrollment[2/] and linear in all other variables. Ordinary least squares is used to estimate all equations. Simultaneous equations bias is expected in the estimates of equations (2) and (3). However, no attempt is made to eliminate this bias because the interdependencies in equations (2) and (3) are not direct and the causality of the equations cannot be clearly established.[3/] Further, operating expenses are used as the measure of educational output (E) in the estimation of equation (2), rather than achievement scores, dropout rates, or attendance rates.[4/]

The dependent variables are:

Y_1 = operating expenses ($ per student in average daily membership). This includes general control, instruction, plant operation, attendance, health, transportation, and fixed charges expenses.

$Y_2 = Y_1$ - transportation expenses/student in average daily membership.

These two variables provide the cost measure for the cost equation (3) and the expenditure equation (4), as well as the measure of E in the social demand equation (2). The predetermined variables are:

2/ Other functional forms used were the inverse of enrollment and the log of enrollment. The results were similar to those presented.

3/ For example, the quantity of financial resources influences the type of teaching staff while the price of characteristics of the teaching staff influences educational output, and through output the quantity of resources provided.

4/ Operating expenses are used as the measure of educational output in equation (2) because 1) there is direct interest in the relationship between the financial resources provided and the characteristics of the district, and 2) attempts by this author to estimate the educational production function with this set of data using attendance rates or retention (1-dropout) rates as measure of educational output have not been very successful. Achievement test results have not been obtained because they cannot be released at the state level. In addition, several batteries of tests are used by the various districts.

Enroll = enrollment in Spring, 1969 ('000 students); the measure of S in the model.

Tax Val = taxable value of real property per student ($'000) in average daily membership.

Med Inc. = the median income of the county in which the district is located from the 1960 Census of Population ($'000), the measure of I.

Med Ed. = the median education of the county in which the district is located from the 1960 Census (years of school); the measure of K.

District = 1 for a city district, 2 for exempted village, and 3 for local.

Mas/TOT = the ratio of teachers with masters degrees to total teachers.

ND/TOT = the ratio of teachers without a bachelors degree to total teachers.

Exp., 1-5 = the ratio of teachers with 1-5 years of experience to total teachers.

Exp., 5-10 = the ratio of teachers with 5-10 years of experience to total teachers.

Exp, over 10 = the ratio of teachers with over 10 years of experience to total teachers.

Te/Pup = the ratio of teachers to Enroll

PFac/En = the ratio of students in poor facilities to Enroll; includes students less than normal day, in excess of normal capacity, and in unsatisfactory rooms as determined by state standards.

En 69/67 = the ratio of Enroll to enrollment in Spring, 1967.

En Sp/Au = the ratio of Enroll to enrollment in Autumn, 1968; a measure of student retention.

ADA/ADM = the ratio of average daily attendance to average daily membership.

Wh/TOT = the ratio of white to total enrollment from a special survey (enrollment not identical with Enroll)

HS/TOT = the ratio of high school student enrollment in Spring, 1969 to Enroll.

The district variable is a rough measure of distinction among types of districts. Factor inputs are measured by teacher degree and experience, the teacher-pupil ratio, and the proportion of students in poor facilities. The growth in spring enrollment from 1967 to 1969 is used as a measure of the dynamic state of the district. The remaining variables represent characteristics of the student body.

In the estimates of the social demand for education, Table 4, enrollment and district were added to equation (2) to determine if size and type of district have an impact on the level of expenditures provided to schools. Enrollment has little impact on social demand except in local districts where district expenditures decline to a minimum at an enrollment level of about 4,750 students. The district coefficients are negative; in equation (2.1), local districts spend $19.20 (2 x 9.60 per student less than city districts, exempted village $9.60 less than city districts. When transportation costs are removed, equation (2.2), the figures are $36.08 and $18.04, respectively.

An increase of $1,000 in taxable property value per student increases expenditures by about $7 per student; the effect is greater in city than in local districts. With a simple correlation of .74, median income and median education are not fully separable in the equations. In the state equations an increase of $1,000 in median income adds $24-30 to school expenditures, an increase of 1 year in median education adds about $9 per student. In the city equation, median income captures the full effect, the coefficient of median education is negative but not significant. In the local equation unit increases in these two variables have similar impacts on school expenditures. The combined effect of these two variables in city districts is about twice as great as in local districts.

Table 4.

Estimates of the Social Demand for Education, per Student, Ohio School Districts, 1968-69[a/]

	Equation				
	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)
Dependent[b/]	Y_1	Y_2	Y_2	Y_2	Y_2
Sample (Observations)	State (638)	State (638)	State (638)	City (168)	Local (420)
Intercept	261.07	242.12	498.03	-2,015.28	656.07
Enroll	0.62 (0.70)	0.74 (0.85)	0.74 (0.84)	0.56 (0.52)	-13.96* (2.28)
$Enroll^2$	-0.00 (0.20)	-0.00 (0.27)	-0.01 (0.75)	-0.00 (0.44)	1.47* (2.19)
Tax Val	7.14* (25.50)	6.98* (24.93)	6.74* (24.07)	7.48* (12.26)	6.30* (20.32)
Med Inc.	23.74* (4.70)	27.30* (5.47)	29.81* (6.06)	59.73* (5.83)	15.94* (2.68)
Med Ed.	8.89** (1.80)	8.43** (1.73)	9.17** (1.93)	-3.10 (0.30)	13.82* (2.48)
District	-9.60* (2.70)	-18.04* (5.14)	-16.75* (4.86)		
En 69/67			-151.02* (3.25)	-430.69* (3.73)	-97.62** (1.90)

a/ t values in parentheses

Significance levels, two-tail t and F

* = .05 level, t(120) = 1.98, F(9,120) = 1.96
** = .10 level, t(120) = 1.658
*** = .20 level, t(120) = 1.289

b/ Y_1 = Operating Expenses/ADM, Y_2 = Y_1 - Transportation Cost/ADM

Table 4 (con'd)

	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)
Wh/TOT			-114.07*	-210.02*	-50.84
			(3.12)	(3.26)	(1.13)
En Sp/Au			-38.69	1,680.93*	-83.04***
			(0.66)	(3.21)	(1.50)
ADA/ADM				1,172.78**	-210.10
				(1.77)	(0.84)
HS/TOT			97.99*	128.39***	9.10
			(2.72)	(1.59)	(0.21)
R^2	0.589	0.611	0.633	0.726	0.573
Adjusted R^2	0.585	0.607	0.627	0.708	0.563
F	150.73*	165.28*	108.15*	41.57*	54.90*

In equations (2.3) to (2.5) additional characteristics are added to the equations. Enrollment growth reduces expenditures per student by $1.51, $4.31, and $0.98 per student per percentage point (.01) increase in enrollment over the two year period, respectively, in state, city, and local districts. An increase in the white-total ratio by .01 reduces expenditures by $1.14 per student for the total sample, by $2.10 for city districts, and by $0.51 for local districts. This implies that the social demand for education of (expenditures on) minority group students is greater than for white students, but not necessarily at the local level. This is a case where greater expenditures on minority group students may be due to special programs at the state or federal level. The student retention rate (En Sp/Au) increases expenditures by $16.80 per percentage point change (.01) in city districts, but reduces them by $0.83 in local districts. Similarly the effect of the attendance-membership ratio is positive in city and negative in local districts. An increase of .01 in the high school-total ratio increases expenditures by $0.98, $1.28, and $0.09 per student in state, city, and local districts, respectively. In general, the level of expenditures for schools is more responsive to district characteristics in city than in local districts. In the case of two variables, En Sp/Au and ADA/ADM, the response in city districts is positive, while it is negative in local districts.

In the cost function estimates, Table 5, there is evidence of economies of scale up to about 8,000 students in the local equation (3.5), and slight diseconomies in the city equation (3.4) over the full range of city districts. However, in the state equation for the total sample, the two enrollment coefficients are small and not significantly different

Table 5

Estimates of School Cost Functions, per Student, Ohio School Districts, 1968-69 [a/]

	Equation				
	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)
Dependent [b/]	Y_1	Y_2	Y_2	Y_2	Y_2
Sample (Observations)	State (638)	State (638)	State (638)	City (168)	Local (420)
Intercept	119.73	129.31	-34.61	-838.84	190.01
Enroll	-0.19	0.01	-0.02	0.96***	-12.79*
	(0.21)	(0.01)	(0.02)	(1.43)	(2.21)
$Enroll^2$	0.01	0.01	0.00	0.00	0.81
	(0.98)	(0.87)	(0.55)	(0.33)	(1.23)
District	8.39*	0.75	1.42		
	(2.10)	(0.19)	(0.38)		
Mas/TOT	611.43*	610.17*	584.73*	490.41*	462.42*
	(12.94)	(13.40)	(13.22)	(7.67)	(7.62)
ND/TOT	-171.12*	-196.20*	-201.32*	-128.89***	-258.91*
	(4.45)	(5.30)	(5.65)	(1.55)	(6.42)

a/ t values in parentheses

Significance levels, two-tail t and F

* = .05 level, ** = .10 level, *** = .20 level

b/ Y_1 = Operating Expenses/ADM, $Y_2 = Y_1$ - Transportation Cost/ADM.

Table 5 (con'd)

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)
Exp., 1-5	125.02**	107.44**	81.75***	167.74***	33.01
	(1.87)	(1.67)	(1.32)	(1.33)	(0.47)
Exp., 5-10	186.70*	181.44*	144.70*	184.16***	193.28*
	(2.64)	(2.67)	(2.20)	(1.44)	(2.58)
Exp, 10+	161.60*	141.60*	109.63*	200.96*	109.32**
	(2.97)	(2.70)	(2.17)	(2.02)	(1.89)
Te/Pup	4,334.74*	4,360.47*	4,776.46*	15,426.08*	3,485.28*
	(14.14)	(14.76)	(14.73)	(16.38)	(9.88)
PFac/En			-65.66*	-48.46	-67.16*
			(2.94)	(1.08)	(2.79)
Wh/TOT			-140.64*		-115.19*
			(3.95)		(2.46)
En Sp/Au			295.23*	428.76	192.84*
			(4.57)	(1.22)	(2.91)
HS/TOT			80.10		
			(2.29)		
R^2	0.573	0.615	0.647	0.868	0.535
Adjusted R^2	0.567	0.610	0.639	0.859	0.522
F	93.61*	111.55*	87.88*	103.05*	42.64*

from zero. The coefficient of district is positive and significant in equation (3.1), but when transportation costs are removed from operating expenses, the coefficient loses significance.

Of the teacher characteristics, an increase of .01 in the proportion of teachers with Masters degrees relative to teachers with bachelors and 5 year degrees increases costs by about $6 per student. Teachers without degrees reduce costs; local school districts have a much higher proportion of non-degree teachers (.18) as compared to city districts (.08). Teachers with 5-10 years of experience have the largest impact on costs of the experience variables relative to teachers with less than one year of experience. An increase in the teacher-pupil ratio by .01 increases costs by $43-48 in the total sample, by $154 in city districts, and by $35 in local districts. A one percentage point increase in this ratio from its mean in Ohio would reduce the number of students per teacher from 21 to 17. The large coefficient for city districts may be due in part to the relatively high correlation of the teacher-pupil ratio with the masters-total ratio (.59) and the no degree-total ratio (-.41). These respective correlation coefficients for the state and local districts are all less than 0.2 in absolute value.

A greater proportion of students in poor facilities reduces costs, as does an increase in the proportion of white students. The direct interpretation is that minority group students require greater expenditures, but again this may be due to special programs at the state and federal level which provide resources for minority group students beyond those included in the cost function, e.g., special classroom facilities and books. The retention ratio and high school-total ratio increase costs per student.

The attendance rate and growth rate had no effect on these equations. As with the social demand estimates, the coefficients of the city equation are generally larger in magnitude than those of the local equation. This is especially true for the coefficient of the teacher-pupil ratio.

The estimates of the reduced form expenditure function in Table 6 are consistent with the estimates of the structural equations in Tables 4 and 5. The relative magnitudes and significance of the coefficients are similar to the results of the structural equations. The absolute magnitudes are reduced, which reflects the interaction between the two equations.

Summary and Conclusions

A simple model of school district behavior is developed and estimated. The model consists of a predetermined supply of students, a social demand for education, and a cost of education. Social demand function, cost function, and reduced form expenditure function, which combines social demand and cost, estimates are presented. All equations are on a per student basis.

Contrary to previous results, the estimates presented in this paper do not show substantial economies of scale. There is some evidence of economies of scale in local school districts and of diseconomies in city districts, but when these are combined with exempted village districts for the total sample there are no economies or diseconomies in the resulting equations. However, this does not contradict previous results. Ohio school districts are large compared to the size of units in other studies. Ohio school districts have largely exhausted economies of scale. In 1968-69 the local districts in Ohio had a mean enrollment of almost 1,900 students, the state over 3,500 students.

Table 6

Estimates of School Expenditure Functions, per Student, Ohio School Districts, 1968-69 [a/]

	Equation				
	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)
Dependent [b/]	Y_1	Y_2	Y_2	Y_2	Y_2
Sample (Observations)	State (638)	State (638)	State (638)	City (168)	Local (420)
Intercept	-71.98	-75.63	155.30	-1,581.85	451.36
Enroll	0.24 (0.35)	0.32 (0.49)	-0.11 (0.17)	0.61 (1.09)	-13.11* (2.63)
$Enroll^2$	0.00 (0.40)	0.00 (0.39)	0.00 (0.51)	0.00 (0.44)	1.00** (1.89)
District	4.38*** (1.46)	-3.27 (1.14)	-2.29 (0.82)		
Mas/TOT	420.45* (11.11)	418.46* (11.53)	405.50* (11.49)	396.00* (7.85)	267.11* (5.60)
ND/TOT	8.54 (0.27)	-15.11 (0.49)	-29.77 (1.01)	77.37 (1.04)	-112.48* (3.33)
Exp., 1-5	94.33** (1.89)	80.15** (1.67)	58.82 (1.27)	81.28 (0.87)	20.81 (0.40)
Exp., 5-10	131.74* (2.48)	133.21* (2.61)	109.25* (2.21)	211.44* (2.23)	147.98* (2.63)
Exp., over 10	135.73* (3.13)	129.44* (3.11)	102.81* (2.53)	189.19* (2.46)	116.64* (2.51)

a/ t values in parentheses

Significance levels, two-tail t and F

* = .05 level, ** = .10 level, *** = .20 level

b/ Y_1 = Operating Expenses/ADM, Y_2 = Y_1 - Transportation Cost/ADM

Table 6 (con'd)

	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)
Te/Pup	3,434.01*	3,525.68*	3,871.83*	11,601.30	2,918.16*
	(14.52)	(15.55)	(15.28)	(14.04)	(10.96)
Tax Val	5.01*	4.79*	4.62*	3.54*	4.53*
	(20.88)	(20.83)	(20.09)	(9.08)	(17.42)
Med Inc.	14.54*	17.42*	18.15*	33.41*	12.30*
	(3.27)	(4.08)	(4.33)	(5.20)	(2.38)
Med Ed.	12.26*	11.24*	10.77*	1.74	11.28*
	(3.11)	(2.98)	(2.86)	(0.32)	(2.48)
PFac/En			-45.88*	-41.98	-48.07*
			(2.75)	(1.26)	(2.68)
En 69/67			-35.74	-41.75	
			(1.00)	(0.64)	
Wh/TOT			-104.22*	-51.09***	-74.28*
			(3.84)	(1.51)	(2.12)
En Sp/Au			228.07*	900.65*	132.33*
			(4.70)	(3.16)	(2.68)
ADA/ADM			-335.00**	335.62	-467.57*
			(1.88)	(0.98)	(2.40)
HS/TOT			43.37***	-42.18	-16.71
			(1.62)	(1.00)	(0.49)
R^2	0.763	0.789	0.807	0.933	0.749
Adjusted R^2	0.759	0.785	0.801	0.933	0.739
F	167.97*	194.65*	143.88*	123.72*	75.20*

Taxable property value, median income, and median years of school of the district are important determinants of expenditures on education, i.e., the social demand function. In addition, local districts provide about $38 less expenditures per student than city districts. This difference is reduced to about $19 when transportation costs are included in operating expenses. Local districts have higher transportation costs than city districts. The rate of growth of the district and the proportion of white students also have negative effects on expenditures.

Teacher experience and degree and the teacher-pupil ratio have major positive impacts on school costs. An increase in the proportion of students in poor facilities reduces operating expenses. The proportion of white students in the district also reduces costs. The retention ratio and the ratio of high school to total students have positive impacts on cost. The attendance rate and growth rate of the district appear to have little impact on costs.

With gains from economies of scale nearly exhausted in Ohio, opportunities for increased efficiency of operation are few. The only major opportunity for reducing costs per student is to reduce the teacher-pupil ratio. The estimates of this study show that by reducing this ratio by .01 (an increase in students per teacher from an average of 21 in 1968-69 to 25) would reduce operating expenses per student by $35 to $154. Production studies indicate that the teacher-pupil ratio has little impact on student achievement, attendance rates, or dropout rates within the observed range of this ratio (a range of 15 to 30 students per teacher covers most of the studies).

Although school boards can control the quality of the teaching staff, changes in quality have a direct impact on educational output. An important unanswered question is the trade-off between class size and the ability of the teacher. How large a class can a teacher with a masters degree and over 10 years of experience handle relative to a teacher with a bachelors degree and 1 year of experience and maintain a constant level of output per student? This problem would assume greater importance should the courts decide in favor of equalization of expenditures or opportunity. While equalization is difficult in itself, if states equalize by increasing expenditures in low expenditure districts, new factor inputs, primarily teachers, must be found to implement the policy. In the short run these new teachers must be attracted from personnel qualified to teach who are currently employed in other occupations. If this is not done efficiently, most of the potential gains from equalization of opportunity may be eaten up by increased teacher salaries.

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